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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/553,095

10/13/2005

Tomoko Aoki

2003JP308

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26289

7590

12/18/2008

AZ ELECTRONIC MATERIALS USA CORP.  
ATTENTION: INDUSTRIAL PROPERTY DEPT.  
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EXAMINER

LACLAIR, DARCY D

ART UNIT

PAPER NUMBER

1796

MAIL DATE

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/553,095	<b>Applicant(s)</b> AOKI ET AL.	
	<b>Examiner</b> Darcy D. LaClair	<b>Art Unit</b> 1796	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 24 September 2008.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-4,6-9 and 12 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-4,6-9 and 12 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

### DETAILED ACTION

1. Note that the name of the examiner to whom this application has been assigned to has changed. The new examiner is Darcy D. LaClair.

All outstanding rejections, except for those maintained below are withdrawn in light of the amendment filed on 9/24/2008.

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

The examiner notes that the serial number noted on the amended claims has a typographical error and should read **10/553,095**.

Upon reconsideration of the claims and an updated search, new grounds of rejection are set forth below were not necessitated by applicant's amendment. Thus, *a 2nd non-final Office action is set forth as follows.*

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. **Claims 3 and 9** are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

With regard to **Claim 3**, discussion of the content of organic resin component added is noted on page 10, line 35 - p. 11 line 10 and page 12 line 23-26. Support for a range having an endpoint of 25% by mass is not seen here, thus this requirement is in violation of the written description requirement of 35 U.S.C. 112.

With regard to **Claim 9**, while support is recognized for the lower endpoint, namely 3 GPa, at least on page 15 line 5, support for the upper end point, specifically 3.5 GPa, or any specific values between 3.0 GPa and 3.5 GPa is not observed. Although Examples 1 – 3, on pages 21—24 do show values of 3.1GPa, 3.2GPa and 3.5 GPa, such support is in the context of specific films of specific polymers, which are themselves obtained from specific monomers. These examples are not commensurate in scope with the amended claims; hence there is a violation of the written description requirement of the first paragraph of 35 U.S.C. 112.

### ***Claim Rejections - 35 USC § 103***

3. **Claims 1, 3-4, 7-9 and 11-12** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Aoki et al. (JP 2002-075982 A)** in view of **Allen et al. (US 6,420,441)**.

**With regard to Claim 1**, **Aoki** teaches a coating composition having a poly alkyl silazane and polyacrylic ester or polymethacrylic acid ester. (see par [0008]) **Aoki** specifies a poly alkyl silazane having a number average molecular weight from 100-50,000 containing a repeat unit expressed with the general formula (2)  $-\text{SiR}^4(\text{NR}^5)_{1.5}-$  where  $\text{R}^4$  and  $\text{R}^5$  are an alkyl group having 1 – 3 carbons or hydrogen atom, but where

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both  $R^4$  and  $R^5$  are not simultaneously hydrogen atoms, or general formula (1):



where  $R^1$ ,  $R^2$ , and  $R^3$  are hydrogen or alkyl

group having 1 – 3 carbons, but where both  $R^1$  and  $R^2$  are not simultaneously hydrogen.

These units are consistent with applicant's formula (1) and (2). (see par [0010],[0011], [0014]-[0016]) Aoki further teaches that the coating composition is obtained by adding polyacrylic ester or polymethacrylic acid ester, (see par [0021]) which has a number average molecular weight of 10,000 to 600,000, or especially 50,000 to 300,000, which encompasses applicant's molecular weight requirement. This includes such homopolymers and copolymers as polymethyl acrylate, polyethylacrylate, poly butyl acrylate, polymethylmethacrylate, polyethyl methacrylate, polybutyl methacrylate, and polyisobutyl methacrylate. (see par [0022]) This is consistent with applicant's requirement for an organic resin component selected from homopolymers and copolymers of acrylic esters and methacrylic esters. The homopolymers and copolymers disclosed by Aoki are composed of monomers such as methyl methacrylate, ethyl methacrylate, butyl methacrylate, methyl acrylate, ethyl acrylate, and butyl acrylate. While Aoki discloses a variety of acrylic and methacrylic monomers, Aoki does not specifically disclose the monomers which contain  $-COOH$  and  $-OH$  groups substituent groups as required by applicant.

**Allen** discloses porous dielectric materials having low dielectric constants useful in electronic component manufacture, (see abstract) and cites silazanes as one of the

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materials in which the invention is useful (see col 10 line 60 - col 11 line 1) Allen discusses a method for reducing the dielectric constant of the material by incorporating within the film very small, uniformly dispersed pores or voids. This is done by incorporating a porogen (see col 2 line 7-15) which are ethylenically or acetylenically unsaturated monomers such as (meth)acrylic acid, meth(acrylates), and similar unsaturated monomers. (see col 4 line 21-25) Allen discloses that particularly useful substituted alkyl (meth) acrylate monomers are those with one or more hydroxyl (-OH) group in the alkyl radical, especially those where the hydroxyl group is found at the  $\beta$ -position (2-position) such as 2-hydroxyethyl methacrylate, 2-hydroxypropyl methacrylate, and 2-hydroxybutyl methacrylate. (col 5 line 35-52) This is consistent with applicant's requirement for -COOH or -OH group contained in at least a part of side groups contained in the organic resin component. Allen describes that certain polymers, when incorporated into a dielectric matrix provide a dielectric matrix material having smaller pores, pores of a lower degree of polydispersity, and a greater percentage of pores by volume. (See col 1 line 66-col 2 line 6) Furthermore, the dielectric material obtained will have low stress, low dielectric constant, improved toughness, and improved compliance during mechanical compacting, as well as lower surface roughness, making subsequent layers applied on the dielectric improved. (see col 14 line 10-31) It would be obvious to follow the teaching of Allen when selecting the organic resin component for the invention of Aoki, and incorporate a portion of the prescribed  $\beta$ -alkyl acrylates in order to obtain these improved pores which yield an improved dielectric material.

**With regard to Claim 3**, Aoki discloses that the polyacrylic or methacrylic acid ester should be added from 5% to 150% of the weight of the poly alkyl silazane, (see par [0023]) which completely encompasses applicant's currently claimed range.

**With regard to Claim 4**, Allen discloses that the alkyl (meth) acrylate monomers can be single monomers or a mixture having different numbers of carbons, and that the monomers can optionally be substituted as described above with regard to **Claim 1**.

Allen discloses that a mixture of monomers, including the substituted monomers, is useful, but does not disclose a particular ratio of unsubstituted to substituted (or -OH or -COOH containing) monomers. Therefore, when faced with a mixture, one of ordinary skill in the art would be motivated by common sense to select a 1:1 ratio, a ratio that falls within the presently claimed amount, absent evidence of unexpected or surprising results. Case law holds that "[h]aving established that this knowledge was in the art, the examiner could then properly rely... on a conclusion of obviousness, 'from common knowledge and common sense of the person of ordinary skill in the art within any specific hint or suggestion in a particular reference.'" *In re Bozek*, 416 F.2d 1385, 1390, 163 USPQ 545, 549 (CCPA 1969).

**With regard to Claim 7 and 8**, Aoki teaches that the poly alkyl silazane does not have less than 50% or not less than 80%, of a repeating unit expressed by formula (2), consistent with applicant's formula (1), based on the combined weight of formula (1) and (2). (see par [0011] )

**With regard to Claim 9**, Aoki teaches a film made of the composition (see par [0013]) which has a specific inductive capacity (which is synonymous with applicant's

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“specific permittivity”) less than 2.5. (See par [0029]) With regard to the elastic modulus, Aoki teaches that the modulus should be 2.5 GPa or greater, but does not specifically teach an elastic modulus from 3GPa to 3.5GPa. (see par [0030]) Allen discloses that the porosity of the dielectric material obtained will have a direct result on the stress, dielectric constant, toughness, and compliance during mechanical compacting of the dielectric material. (see discussion with regard to **Claim 1**, above, and Allen, col 14 line 10-31) Incorporating the alkyl meth(acrylates) described by Allen in the poly alkyl silazane resin of Aoki, would lead to an improvement of Aoki’s properties, such as toughness and compliance. This is consistent with an improvement in the elastic modulus. Furthermore, it appears that the discrepancy between the examples of Aoki (see Example 1-2, par [0044]-[0046]) and the examples provided by applicant (see specification Example 1-3, p. 21-24) is primarily contained in the (meth) acrylate monomers employed. Specifically, applicant employs monomers such as iso or n-butyl methacrylate and hydroxyethyl methacrylate, and achieves elastic moduli in the range 3.1GPa to 3.5 GPa. It is the position of the examiner that the improved porosity of the invention of Aoki in view of Allen, as described above with regard to **Claim 1** would have an elastic modulus further improved over that disclosed by Aoki. Since Aoki teaches resins which are 2.5 GPa or greater, it is expected that resins with an elastic modulus higher than that, or within the range of 3 GPa or greater, would be achieved by the combination of these inventions.

**With regard to Claim 11**, Aoki teaches that the invention relates to coating composition which gives a porous film (see par [0001]) used as an interlayer insulation film for semiconductors. (See par [0002])

4. **Claims 6** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Aoki et al.** in view of **Allen et al.**, further in view of **Sunao et al. (JP 07-292321 A)**.

The discussion, above in **paragraph 3**, with regard to **Aoki and Allen**, is incorporated here by reference.

**With regard to Claim 6**, Aoki teaches two formulas for poly alkyl silazane. Aoki further specifies that in formula (2),  $R^4$  is a methyl group and  $R^5$  is a hydrogen group, which is consistent with applicant's requirement that in applicant's formula (1),  $R^1$  represents a methyl group and  $R^2$  represents a hydrogen group. In Aoki's formula (1)  $R^1$  and  $R^2$  are hydrogen or methyl groups, and  $R^3$  is a hydrogen atom. This is consistent with applicant's requirement for formula (2) that  $R^3$  and  $R^4$  are hydrogen or methyl groups, and  $R^5$  is hydrogen. (see par [0011]) This is consistent with applicant's requirements for the substituent groups.

With regard to applicant's formula (3), this shares significant similarity with applicant's formula (2) or Aoki's formula (1), with the exception that the polymerizing bond from the silicon atom contains a terminating  $R^8$  group rather than a connection with another monomer group. With regard to  $R^6$ ,  $R^7$  and  $R^9$ , which are structurally equivalent to Aoki's  $R^3$ ,  $R^1$  and  $R^2$ , it would be obvious to employ the same teachings as those given by Aoki for the analogous groups on Formula (1).

In the case of a terminating group, which must exist for any polymer, the bond would lead to some type of a chemical group. Aoki does not disclose the particulars of this terminal group. Sunao discloses a poly alkyl silazane composition having similar components. (see par [0007] Formula (I) and [0012] Formula (3)) Sunao discloses that a unit with this general formula can have the “end of a main skeleton” (terminal group) be linear and have the same basis as the  $R^1$ ,  $R^2$ , or  $R^3$ , or hydrogen, described for formula (I). (see par [0018]). This “end of a main skeleton” would be equivalent to applicant’s R8. It would be obvious, given that a polymer chain must have an end group, to follow the teachings of Sunao for a polymer chain composed of the same groups, and to use a hydrogen or alkyl group. Taken in combination with Aoki’s teachings that a methyl group is a particularly suitable alkyl group, and the case where  $R^1$  and  $R^2$  are both hydrogen is excluded, (see Aoki par [0016]) it would be obvious to employ a methyl group as the terminal group for this structure.

### ***Response to Arguments***

5. Applicant's arguments filed **9/24/08** have been fully considered. Specifically, applicant argues (A) the rejections of the claims as anticipated by Sunao (JP 07-292321) and unpatentable over Sunao in view of Aoki et al. (JP 2002-075982) are traversed and (B) formula (I) would be well understood by the skilled artisan, as supported by the documents submitted as Exhibit A, B, and C.

6. **With respect to argument (A)**, Applicant's arguments have been considered but are moot in view of the new ground(s) of rejection.

**With respect to argument (B)**, applicant's arguments and exhibits have been considered, and the rejection under 35 U.S.C. 112 is withdrawn in light of the exhibits and further consideration.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Darcy D. LaClair whose telephone number is (571)270-5462. The examiner can normally be reached on Monday-Friday 8:30-6.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vasu Jagannathan can be reached on 571-272-1119. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Darcy D. LaClair

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Examiner  
Art Unit 1796

/DDL/

/Vasu Jagannathan/  
Supervisory Patent Examiner, Art Unit 1796